

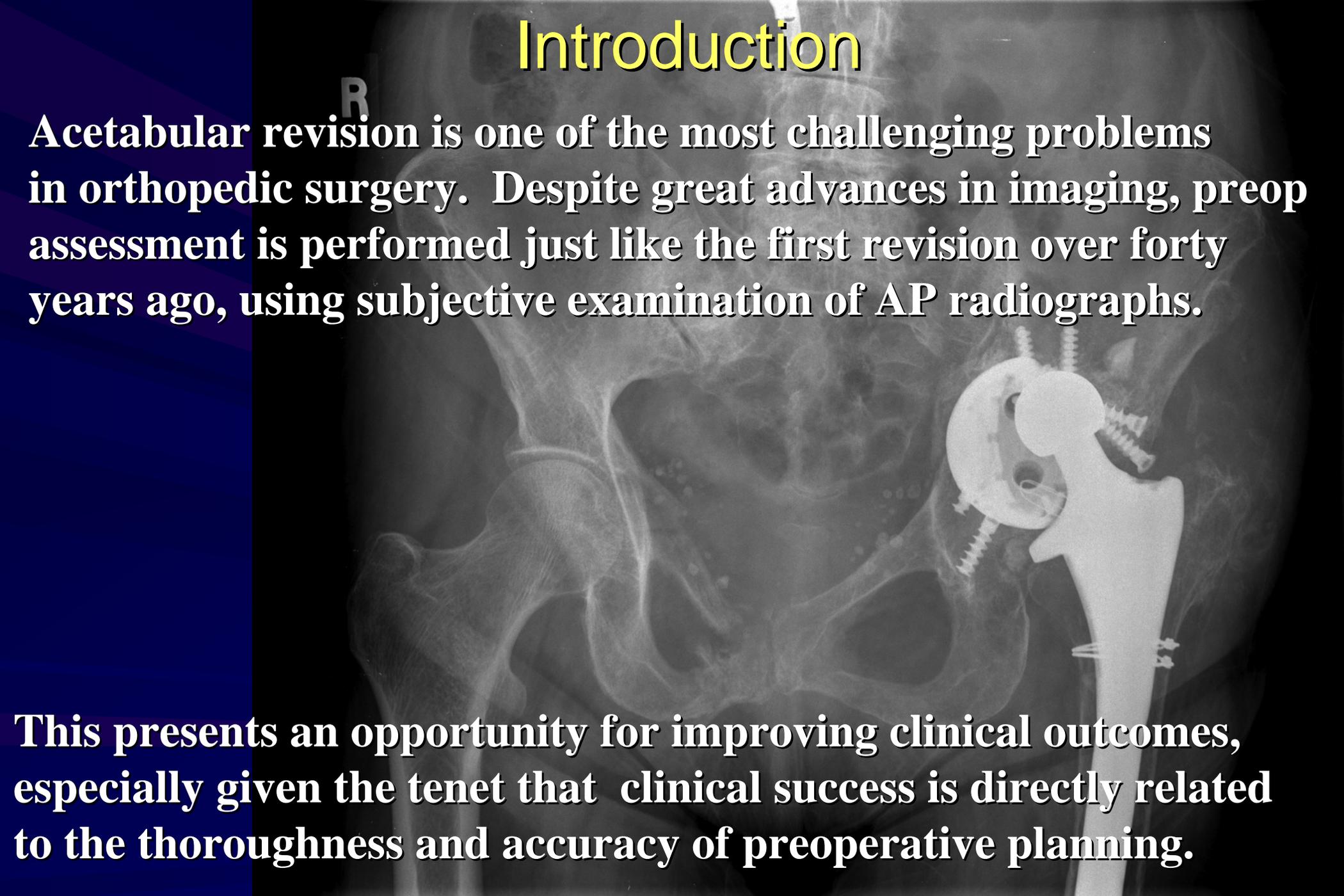
Severe Acetabular Defects: Image-Guided Reconstruction

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Workshop on Image-Guided Interventions

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Introduction

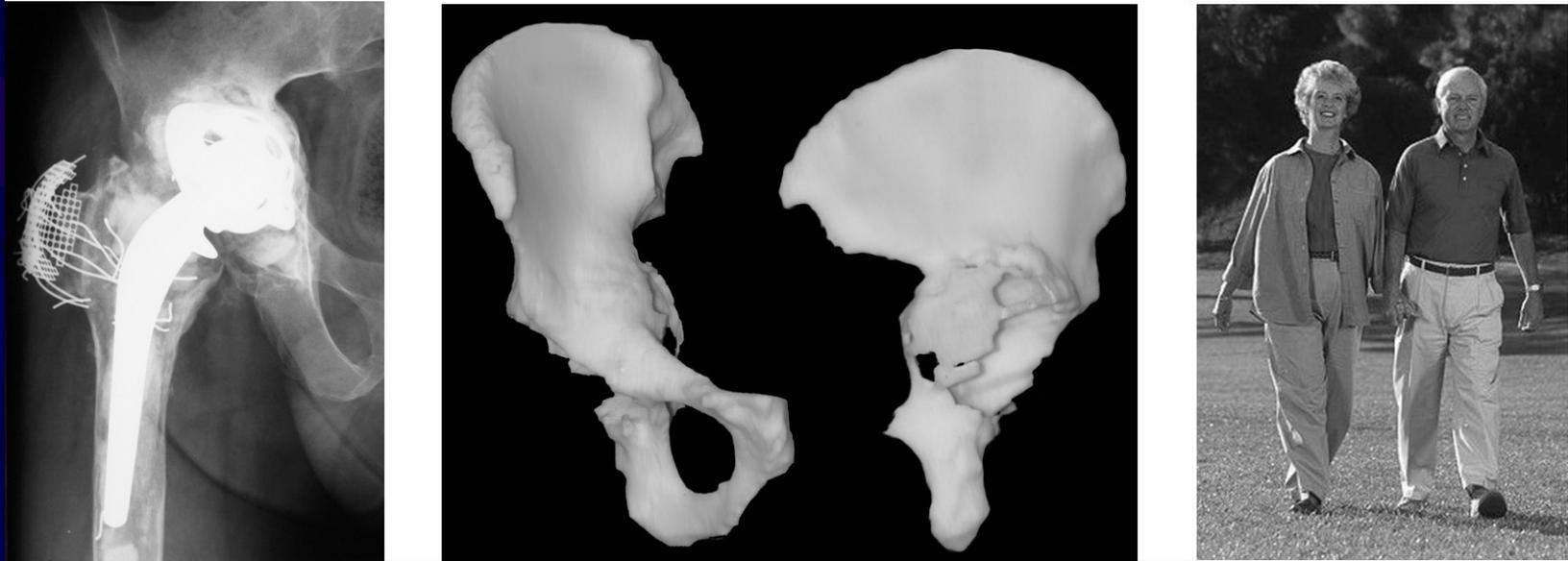
An anteroposterior (AP) radiograph of a human pelvis. The right hip (marked with an 'R') shows a revision acetabular component, which is a large, circular, metallic shell with multiple locking screws. A femoral stem is also visible, extending downwards from the hip joint. The background is a dark blue gradient.

Acetabular revision is one of the most challenging problems in orthopedic surgery. Despite great advances in imaging, preop assessment is performed just like the first revision over forty years ago, using subjective examination of AP radiographs.

This presents an opportunity for improving clinical outcomes, especially given the tenet that clinical success is directly related to the thoroughness and accuracy of preoperative planning.

Introduction

Ideally, surgical planning should accurately describe the amount and location of remaining bone.



Our goal is to develop CT-based structural-imaging techniques to guide surgery by describing host bone.

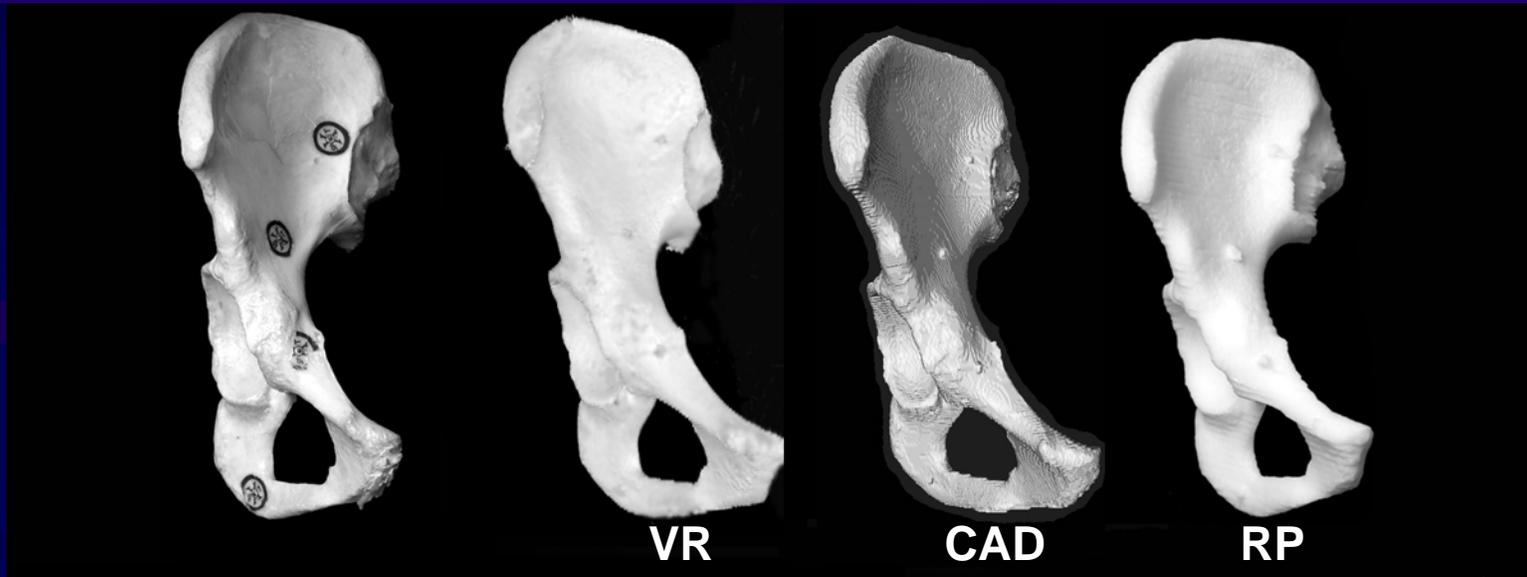
- Hypothesis: structural-imaging accurately ($\pm 2\text{mm}$ linear measurements, $\pm 3\%$ volume measurements, $\leq 15\%$ bone density errors) and reliably (inter-observer, $\kappa \geq 0.80$) define 3D structure.

Preliminary Results- Aim 1 Linear Measurements

CT image sets overestimated caliper measurements, on average, by 0.3 ± 0.4 mm

3D models underestimated caliper measurements, on average, by 0.4 ± 0.9 mm .

Caliper, CT, and model measurements were highly **reliable**, with average repeat measurement differences of 0.1 mm.



Preliminary Results- Aim 1 Density Measurements

Periprosthetic CT values within tissue equivalent cylinders can be corrected to their true values

$$CT_{\text{true}} = 0.91 CT_{\text{meas}} - 14.5$$

